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EXPANSION OF GREEN AREAS IN CITIES THROUGH SOILLESS CULTIVATION OF VEGETABLES

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ABSTRACT

Soilless culture or hydroponics is the technique of growing crops in soil-less media using nutrient solutions. Soilless culture encourages growing plant in areas where soil is lacking or soil is present but contaminated with disease causing organisms or toxic substances. People living in crowded city without gardens can grow vegetables in window-boxes or in small discarded containers by using principles of hydroponics. This technology is suited for growing vegetables like tomato, sweet pepper, brinjal, cucumber, melon, french bean, radish, cabbage, cauliflower, lettuce, spinach, potato, spring onion, etc. Here we discuss why we should need soilless cultivation in Kerala.

KEY WORDS: Soilless Cultivation, Vegetables, Kerala

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INTRODUCTION

Soilless culture is adopted as a means of replacing the natural soil system with either an aerated solution or an artificial soil composed of chemically inert aggregates moistened with nutrient solutions. On the basis of nature of media used, the hydroponic systems are classified as liquid hydroponics (solution culture), Aggregate system (solid media culture) and aeroponics. Basic requirements are growing media, nutrient solution, fresh air, water, mineral nutrients and light. Electrical conductivity, pH, temperature, dissolved Oxygen content and nutrients level in the nutrient solution should be properly checked and managed. Aeroponics is a method of growing plants where they are anchored in holes in styrofoam panels. Their roots are suspended in air beneath the panel. The nutrient solution is sprayed in fine mist form to the roots. A more recent, very interesting new topic is aquaponics. The combination of hydroponics for plant cultivation with nutrient solution and aquaculture for fish farming has created this technology. Water with the fish feces is pumped from the fish tank and turn them into nutrition for the plants. In return the plants clean the water to be pumped back into the fish tank. Subsequently, both systems are benefitting.

Soilless Culture as we know It

The roots of crops can absorb a balanced nutrient solution dissolved in water using the techniques of hydroponics that meets all the plants developmental requirements. Most commercial hydroponic growers merge hydroponic technology with a controlled environment to get the highest quality produce. In a green- house structure you can control the ambient temperature, humidity and light levels which permits you to grow vegetables on a year-round basis.Higher yield and quality produce are ensured in this environment friendly method. There is no

incidence of soil borne pest and diseases. Dr. W. F Gericke in 1936 of the University of California came up with the term hydroponics from the Greek hydro (water) and ponos (work), meaning working with water.

Why we should need soilless cultivation in Kerala?

In most of the states of India, the urbanization process goes along with increasing urban poverty and polluted environment. Urban horticulture is the most aggressive area of urban farming due to the high cost of urban land and with the need of high water- and fertilizer-use efficiency. The urban population expansion in Kerala is more prominent today. According to 2011 census data, 47.7 % of population lives in urban area. In India it is 31.16 %. Net area sown as percentage to Geographical area is 53.50 only. Area of barren and uncultivable land is 16354 hectares (Farm guide, 2015). Of the land not available for cultivation (excluding forests), the share of land put to non-agricultural uses increased consistently from 72.3 per cent in 19 1975-76 to 93.3 per cent in 2005-06 mainly due to increasing demand for residential houses, industry and transportation. It is interesting to note that the utilization of land for housing is high in Kerala compared to other parts of India. The average per-capita floor area of the houses in Kerala was 14.50 square metres in 2007-08, the highest among the Indian states. The national average is only 8.67 square metres. The difference between rural (14.32 square metres) and urban areas (15.012) is minimal in Kerala (India, 2010). Barren land and permanent pasture have been decreasing consistently. If the same trend continues there will hardly be any barren and uncultivable land or permanent pastures and other grazing land. This trend is as a result of the effect of population pressure which led to the increased use of all available land. But its effect was found mainly on land put to non-agriculture uses rather than on extending agriculture to fallow land and cultivable waste (Devi and Kumar, 2011). Here we discuss why we should need soilless cultivation in Kerala.

Deforestation and urbanization process resulted in reduction of fertile land and the environment became more polluted. Soilless culture has more importance in the scenario of high competition for land. Vegetables are important part of daily diets. They are rich in minerals, vitamins and antioxidants. Hence, they are playing the role of protective foods. ICMR recommends a daily intake of 300-350 g of vegetables for an adult. In addition to their dietary benefits, vegetables are high income generating crops for small scale farmers. It can be taken for home consumption as well as income generation source. Innovative technologies have been developed in order to address the cultivation in non arable soil and limited space. Soilless culture of vegetables can be encouraged in such area. Roof top of houses, balconies even walls can be utilized for that. City dwellers will enjoy such green areas as a place of relaxation and quality vegetables will reach their doorstep.

The advantage of vegetable production by simple hydroponics technology is based on the fact that large amounts can be produced in a short time from a small area. Field crops such as cereals and tuber crops have no chance to compete (Keatinge *et al*., 2011). In Kerala hydroponic cultivation has considerable potential in future. In metropolitan areas land is not available for cultivation. Less Attention has been given to improving the sandy, acidic soil or the damaged soil of the south in Kerala state, where the blackish water of the Arabian Sea has invaded the land. Soilless culture can be adopted in such areas to overcome this problem. Generally high-tech greenhouses are used for soilless cultivation. It requires only basic agricultural skills. For a successful soilless cultivation supply of nutrients for substrates should be ensured. The techniques include usage of locally available substrates like cocopeat, gravel, sand, peat moss, saw dust, vermiculite, perlite, rockwool etc. Perlite has good structural stability and is available at low cost. FAO helped many developing countries to establish soilless farming on the rooftop of houses. With the support of FAO, Egyptian government initiated

the "Green food from green roofs" program that encouraged residents to grow their own vegetables in beds and containers filled with rice husks, sand or peat moss, fertigating the plants hydroponically (FAO, 2010). It is a cheap and easy way of growing vegetables. In comparison to traditional open field production and conventional irrigation, the water-use efficiency is considerably high in closed soilless culture systems. Hydroponic cultivation is saving on cost for transport, packaging and storage of the products. Rooftops planted with vegetables lowers temperature in the homes.

Our Government should also give focus on giving subsidies for soilless culture of vegetables. For simple implementation of this program, agriculture department or VFPCK should come forward to provide premixed soluble fertilizers to be added into the tank at the recommended quantity per liter of irrigation water for regular nutrient supply to the plants. Trainings can be arranged for the proper technological knowledge to families especially for women. The New York Company "Better Food Solutions" set up hydroponics garden on the roof. The result is a much more environmentally friendly produce that tastes great and can simply be sent downstairs for sale. The benefit for the consumer is fresher produce that has gone from harvest to shelf within a short time. Such a system of rooftop gardens has also great potential for restaurants and even residential properties (Theduke, 2011).

Compost from horticultural greenhouse crop waste was used as a growing media in vegetable crop production. Its suitability was examined and compared to other substrate alternatives like coconut coir waste. One experiment was done to compare this compost with coconut coir waste in terms of the yield and fruit quality of tomato crops (*Lycopersicon esculentum* Mill. Cv Daniela). The results indicated that compost is an acceptable growing media as a alternate for rockwool and similar to coconut coir waste in soilless vegetable cultivation (Urrestarazu and Salas, 2003). According to literature, yield, fruit color, uptake of nutrients, fruit dry matter content and the chemical composition of tomato fruit vary with different substrates (Elia et al., 2001). Coco peat can be used crops for up to five years in hydroponic systems. Vermicompost is the outcome of organic waste consumed by earthworm. It is digested, and excreted in the form of granules. Nutrient contents in the vermicompost include nitrogen (3-5%), phosphorus (0.3%), potassium (0.56%), and micronutrients (traces) (Athani et al., 2007).

Dayananda and Ahundeniya (2000) studied growth parameters and yield of lettuce in relation to hydroponic systems. Nutrient flow system, non circulatory system and aggregate system were compared. The highest yield was recorded in the aggregate system (2340 g/m^2). Same study also confirmed that coir dust showed the most effective results giving higher values for root length, total leaf area, fresh weight and dry weight. Coir dust alone or mixed with partially burnt paddy husk or burnt paddy husk alone make good growing media for lettuce cultivation under control environments

. Correa *et al.* (2008) compared potato seed tuber production of cvs. Monalisa and Agata growing in beds, pots and hydroponics with either single or staggered harvests. The number of tubers per plant in hydroponics was 147% higher than the bed and pot system for single harvest. Tuber production from a staggered harvest in hydroponics was 286% higher than in the bed and pot systems for both the cultivars. Fujiwara *et al.* (2012) studied on suppression of bacterial wilt disease of tomato by an organic hydroponic system. Many of the tomato seedlings in the conventional inorganic hydroponic system were wilted and died. But none of the seedlings in the organic hydroponics wilted or developed any symptoms.

In New Zealand (Nichols and Lennard, 2010) have demonstrated that aquaponics production can exceed conventional hydroponic production in the right situation. Lower productivity was observed in the aquaponic system in the winter when the fish were relatively not active due to low water temperatures, and the feeding rate was reduced, resulting a lower production of plant nutrients. But during the warmer summer months higher yields from the aquaponic system were

obtained.

An economic comparison of soilless and soil-based cucumber production was done by Engindeniz and Gul, 2009 in Turkey. Study indicated that soilless cucumber production is an economically feasible alternative to soil-based cucumber production. Variable and fixed costs of soilless production were higher than soil-based production. Compared to soil-based systems material costs and total costs were higher for soilless culture systems. Adjusted cost and operating costs were generally lower and overall crop yield goes beyond the soil-based one. Net return of soilless production (€ 1.84 m^{-2}) was higher than soil based production (€ 1.48 m^{-2}) because its yield and gross revenue are higher.

CONCLUSIONS

Advancement in hydroponics cultivation of vegetables has been fast and results obtained in various places have confirmed that this technology is thoroughly practical and has very advantages over conventional methods of crop production. Thus not only is it a profitable undertaking, but one which has proved of great benefit where limited land is available for cultivation. And there is an added advantage for vegetables produced by aquaponics technology. Since no pesticides and mineral fertilizers are used in the system, the produce should eventually qualify for an organic product certification.

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